BOOK REVIEW

Geochemistry of Marine Sediments

David J. Burdige
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The uplift of rocks above sea level on the Earth's surface over geologic time produces material that can be altered into soils and sediments by weathering processes. Over time, a fraction of sediments are sequestered in ocean basins, with most of it stored in the coastal margin. Sediments produced from weathering of igneous, metamorphic, and sedimentary rocks are transported primarily to the oceans through the world's river systems. The storage of organic matter in marine sediments is largely dependent upon the amount of early diagenesis (processes that alter the structure, texture, and mineralogy of a sediment, turning it progressively into solid hard rock; early diagenesis occurs immediately after deposition or burial of the sediment) that occurs in the upper sediments, which is controlled largely by the "quality" of organic detrital inputs and redox conditions of the sedimentary environment.

Human understanding of such processes, perhaps now more than ever, is critical because of their profound effects on the global carbon cycle. Advances in the understanding of mineral–organic matter interactions, new techniques in bulk and chemical biomarker analysis of organic matter, and new approaches in diagenetic modeling have created a serious demand for a comprehensive update of Robert Berner's classic text, *Early Diagenesis: A Theoretical Approach,* published in 1980.

Geochemistry of Marine Sediments, by David Burdige, provides an excellent update on a broad spectrum of topics in marine geochemistry. All 18 chapters are well written and provide comprehensive background materials in areas such as physical/chemical properties of sediments, controls on pore-water constituents, sediment microbial processes, biotic versus abiotic processes, the application of stable isotopes and chemical biomarkers in paleo and modern environments, metal cycling, hot vents/cold seeps, and new modeling approaches to better quantify early diagenesis.

Chapters 1 and 2 begin with an overview of the conceptual format of the book, as well as the origin (e.g., authigenic, lithogenic, and biogenic), distribution, and classification of sediments, respectively. In chapter 2, Burdige discusses differences between siliciclastic and carbonate sediments, which provides a sound basis for later discussions in the chapter on surface area, ion exchange, and sediment regimes. Chapter 3 introduces the field of isotope geochemistry, providing the reader with a solid background on the basics of radioactive decay, applications of isotopes, and stable isotopes, concluding with radiocarbon.

To me, chapters 4–6 represent a superb summary of how sediment geochemists today approach the problems (e.g., steady state versus nonsteady state) of modeling diagenesis in a diversity of marine sedimentary environments. Chapters 7–12 provide information on organic geochemical, microbial, and macrobiological properties of sediments, and the information is effectively integrated and applied to important questions of diagenesis.

Chapters 13 and 14 cover the geochemistry of deep-sea pelagic sediments, with some nice details on the geochemistry of trace metals, nodules, and turbidites, as well as calcium carbonate diagenesis. The remaining sections of the book, chapters 14–18, delve into carbon preservation, as it relates in part to oxygen exposure and surface area effects. A comprehensive review of important biogeochemical cycles such as nitrogen, phosphorus, sulfur, and carbon in margin sediments is also included in these sections. Burdige appropriately concludes the book with a final chapter that focuses on linkages between sediment cycling and global elemental cycles.

Overall, *Geochemistry of Marine Sediments* will provide an important resource for instructors and students. In this extraordinary tour de force, Burdige captures the complexity and growing interdisciplinary nature of the field of marine geochemistry. Other added features of this book are superb graphical illustrations, tables, and a reasonable price. In some sections of the book, additional figures may have been more effective than detailed verbiage on certain topics; however, this is something that can be considered for the next edition. I highly recommend this book to all colleagues and students in the fields of geosciences. The book is sure to become a standard text for years to come.

—THOMAS S. BIANCHI, Department of Oceanography, Texas A&M University, College Station